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a first layer that exhibits semiconducting properties and surrounds the electric conductor,

a solid insulating layer surrounding the first layer, and

a second layer that exhibits semiconducting properties and surrounds the insulating layer; and

a brushless excitation system, switchable between positive and negative excitation modes of operating, configured to excite the alternating current rotary electric machine.

20. A machine as claimed in claim 19, wherein:

a potential on the first layer is substantially equal to a potential on the conductor.

21. A machine as claimed in claim 19, wherein:

the second layer is arranged to form a substantially equipotential surface surrounding the conductor.

22. A machine as claimed in claim 21, wherein:

the second layer is connected to a source of a predetermined potential.

23. A machine as claimed in claim 22, wherein:

said predetermined potential is earth potential.

24. A machine as claimed in claim 19, wherein:

at least two adjacent layers of the electric winding have substantially equally large coefficients of thermal expansion.

25. A machine as claimed in claim 19, wherein:

the conductor comprises a number of strands, at least some of which are in electric contact with each other.

26. A machine as claimed in claim 19, wherein:

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each of said first layer, said insulation layer and said second layer is firmly joined to adjacent layers along respective entire contact surfaces.

27. A machine as claimed in claim 26, wherein:
said layers are arranged to adhere to each other even when the electric winding is bent.

28. An alternating current rotary electric machine configured to be connected directly to a distribution or transmission network, comprising:

a magnetic core;

an electric winding formed from a cable having

a current-carrying conductor having a number of strands,

an inner semiconducting layer arranged around the current-carrying conductor,

an insulating layer of solid insulating material arranged around said inner semiconducting layer, and

an outer semiconducting layer arranged around the insulating layer;

and

a brushless excitation system, switchable between positive and negative excitation modes of operating, configured to excite the alternating current rotary electric machine.

29. A machine as claimed in claim 28, wherein:

said cable comprises at least one of a metal screen and a sheath.

30. A machine as claimed in claim 28, wherein:

the brushless excitation system comprises

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two controllable antiparallel-connected current converter devices
configured to feed a field winding machine,
at least one of a two-way field over-voltage protection mechanism and
a discharge circuit connected across the field winding, and
control equipment configured to control current converters and a field
over-voltage protection mechanism or discharge circuit.

31. A machine as claimed in claim 30, wherein:

the control equipment is configured to change a polarity of the current converters for
switching a direction of the excitation current from the excitation system, and

the control equipment configured to cause the over-voltage protection mechanism to
be temporarily connected at transition from one to the other current direction.

32. A machine as claimed in claim 31 wherein:

at least one of the over-voltage protection mechanism and the discharge circuit
includes a two-way thyristor discharge circuit.

33. A machine as claimed in claim 32, wherein:

at least one of the activated over-voltage protection mechanism and the discharge
circuit when activated is resettable by control of conducting converter devices to temporary
or pulse-formed change of polarity modes of operation.

34. A machine as claimed in claim 32, wherein:

at least one of the activated over-voltage protection mechanism and the discharge
circuit when activated is resettable by extinguishable semiconductor elements.

35. An electric power plant comprising:

an alternating current rotary electric machine configured to be connected directly to a
distribution or transmission network, having an electric winding with

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an electric conductor,

a first layer that exhibits semiconducting properties and surrounds the electric conductor,

a solid insulating layer surrounding the first layer, and

a second layer that exhibits semiconducting properties and surrounds the insulating layer; and

a brushless excitation system, switchable between positive and negative excitation modes of operating, configured to excite the alternating current rotary electric machine.

36. A method of exciting a rotary electric machine with both positive and negative excitation current directions, comprising steps of:

temporarily connecting at least one of a two-way field over-voltage protection mechanism and a two-way discharge circuit across field windings of the machine during an excitation operation; and

switching between the positive and negative excitation current directions.

37. An alternating current rotary electric machine with both positive and negative excitation current directions and being configured to be connected directly to a distribution or transmission network, comprising:

field windings;

means for protecting said alternating current rotary electric machine for an over-voltage protection event;

means for temporarily connecting said means for protecting across the field windings during an excitation operation; and

means for switching between the positive and negative excitation current directions.--